WEST

Generate Collection

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DOCUMENT-IDENTIFIER: US 5747311 A
TITLE: Process for chemical modification of reactants by microbes

BSPR:
The chemical modification process of the present invention permits efficient and rapid modification of a variety of reactants. The method is particularly useful to treat sewage, to treat groundwater toxics, and to nitrify and denitrify the water used in aquaculture fish production. Using the methods of the present invention, bioreactors having much shorter hydraulic retention times relative to conventional processes are possible. These shorter retention times permit aquaculture production of fish using recycled waters which makes such production economically efficient, particularly in environments where water is scarce. In sewage treatment applications, using the methods of the present invention, hydraulic retention times as short as several minutes are possible. Furthermore, the exceptionally high interfacial surface areas used in the methods of the present invention permit the use of organisms in processes which have relatively low biochemical conversion rates. In addition, using methods of the present invention with horizontal as well as vertical flow, head loss through the bed, suspended solids management, and biofilm management can each be optimized in a single bioreactor.

DEPR:
The particulate material comprises a carrier and microbes attached to the carrier. Microbes suitable for the practice of the present invention include bacteria, viruses, yeast, fungi, protozoa, plant cells, and animal cells. Selection of a particular microbe for a particular application is based upon a number of factors which will be apparent to those skilled in the art, such as the nature of the reactant being converted, the necessary conversion efficiency, the availability of microbes capable of effecting the conversion, the conditions under which the reaction is to be conducted (temperature, presence or absence of oxygen, presence or absence of other materials contaminating the reactant or byproducts of the reaction which are toxic to the microbes), the carrier employed, and the ease of attaching the microbes to the carrier. By way of illustration, microbes suitable for the treatment of wastewater include aerobic bacteria, such as nitrifiers and methanotrophs, and anaerobic bacteria, such as acetogens and methanogens. Where the reactant is ammonia, such as ammonia produced as a waste product in aquaculture fish production, microbes capable of effecting nitrification include Nitrosomonas and Nitrobacter. Denitrification of nitrate reactants can be effected using a variety of denitrifiers, such as Pseudomonas. A number of microbes have been employed in the biosynthesis of organic molecules from organic reactants. For example, microbes are employed in the production of alcohols, such as ethanol, from sugars (such as glucose, fructose, sucrose, and xylose), starches, and cellulose. A number of microbes have been employed in these conversions, including yeast (such as Saccharomyces cerevisiae), Clostridium thermocellum, Thermoanaerubacter ethanolicus, and, preferably, Zymononas mobilis. The present invention also contemplates the use of microbes genetically engineered to effect conversions which, at present, are typically conducted in batch processes, as described, for example, in Martin, ed., Bioconversion of Waste Materials to Industrial Products, New York : Elsevier Applied Science, 1991, which is hereby incorporated by reference. Such conversions can be used, for example, to produce vitamin B.sub.12 (Corrinoide), ubiquinone, and acetic acid. The methods of the present invention are particularly suitable to effect conversion of raw feedstocks to biologically

active therapeutics, such as drugs. These biologically active therapeutics include human insulin, digitalis, vaccines, parathyroid hormones, and monoclonal antibodies.